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December 7, 1998

VIA HAND DELIVERY

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
The Portals TW-A325
445 12th Street, S.W.
Washington, DC 20554

Re: Our File 07147/005001
ET Docket No. 98-153
Comments of Zircon Corporation

Dear Ms. Salas:

Enclosed are an original and four copies of comments for Zircon Corporation in the above-captioned proceeding.

Please contact the undersigned if you have any questions regarding this matter.

Very truly yours,

Terry G. Mahn

/seg
Enclosures

cc: Charles E. Heger, Zircon Corporation
John A. Reed, FCC
Julius Knapp, FCC

93330.W11

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems	)	Docket No. 98-153

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

COMMENTS OF ZIRCON CORPORATION

Zircon Corporation, by its undersigned counsel, hereby submits these comments in the above-captioned Notice of Inquiry (NOI). As an early developer of ultra-wideband (UWB) radar technology, Zircon is keenly aware of the issues raised in this proceeding. On April 14, 1998, Zircon filed a petition[1] for waiver of the Part 15 Rules to market a prototype "construction tool" designed to locate rebar embedded in concrete. Zircon's waiver petition is currently pending. For the reasons set forth in its petition and as explained further below, Zircon urges the Commission to proceed expeditiously with this NOI and to issue a follow-on Notice of Proposed Rulemaking to permit the authorization of low power UWB devices under Commission Rules.

[1] Zircon hereby incorporates the comments submitted with its waiver petition into this proceeding.

Background

Zircon's interest in UWB radar technology derives from its commitment as a leading manufacturer of construction tools to make work sites as safe as possible. UWB radar technology permits workers in the construction, remodelling and demolition industries to "see inside" solid structures to located hidden dangers such as rebar, nails, wires and pipe materials.

Using a patented pulsed radar design licensed from Lawrence Livermore Laboratories, Zircon has developed a prototype rebar location device that generates pulsed emissions between 200 MHz and 4 GHz with a spectral power density of only 3×10^{-8} watts/MHz. The device features a nominal pulse width of 100 pico seconds and a pulse repetition rate, randomly varied in time, of between 1 and 20 MHz. Because the device "looks" for rebar at depths of only 12 to 18 inches beneath the surface, it operates at power levels well below those permitted by Part 15 for unintentional emitters. Indeed, a sample device sent to the FCC Laboratories shortly after the filing of Zircon's waiver petition was initially reported to be "non-functioning" by the Commission's test engineer because emissions could not be detected above the noise floor. Subsequent testing in an anechoic chamber revealed an emission profile approximating that of Gaussian white noise (see Attachment I).

Despite generating nearly imperceptible levels of RF energy, Zircon's device is not capable of being authorized under the Part 15 Rules for two reasons: (1) because it is thought to produce "fundamental" emissions in the so-called restricted (and broadcast) bands[2]; and

[2] See 47 CFR §§ 15.205 and 15.209(a).

(2) because such emissions are of a "damped" nature.[3] In the context of a UWB emitter exhibiting white noise-like emissions, however, neither of these prohibitions makes sense technically or from a public policy perspective and, therefore, should be eliminated in a rulemaking proceeding.

Regulatory Treatment

The NOI requests comment on the definition of "ultra-wideband" and on whether UWB devices should be authorized under the Part 15 rules or another of the Commission's regulatory programs. On the definitional issue, Zircon generally supports the industry-accepted definition that a UWB device is one whose fractional bandwidth is ≥ 25% of the center frequency of the radiated emissions, where the center frequency of the radiated emission is generally determined by the antenna[4] used with the device.[5] For UWB devices operating above 1 GHz, however, Zircon suggests modifying this formula so as not to restrict UWB operations at higher center frequencies of the radiated emissions, such as 20 to 100 GHz, where antenna structures may not support the required bandwidth to meet the simpler, unmodified definition of UWB.

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[3] See 47 CFR §§ 2.201(f) and 15.5(d).

[4] See 47 CRF § 15.203 which requires compliance with the device's antenna installed.

[5] Fractional bandwidth is defined as $2(f_H-f_L)/(f_H-f_L)$, where f_H and f_L represent the designated band edges (e.g. 3 dB, 6 dB or 20 dB bandwidths). See Assessment of Ultra-Wideband (UWB) Technology, OSE/DARPA Ultra-Wideband Radar Devices Panel, A-6280, July 13, 1990.

Zircon further suggests use of the formula -- $2^{[\log\{(f_H+f_L)/2\}-9]}[2(f_H-f_L)/f_H+f_L)]$ -- for defining fractional bandwidth above 1 GHz.[6] The results are shown in the following table:

$(f_H+f_L)/2$	% fract. BW (per formula)	Fractional Bandwidth (per formula)	Fractional Bandwidth (without formula)
1 GHz	25.0 %	.25 GHz	.25 GHz
2 GHz	20.3 %	.41 GHz	.50 GHz
10 GHz	12.5 %	1.25 GHz	2.5 GHz
20 GHz	10.1 %	2.0 GHz	5 GHz
100 GHz	6.3 %	6.3 GHz	25 GHz

Although "ultra-wideband" is a relative term, it provides an important demarcation for the broad range of technologies that feature low power pulsed emissions that are randomly varied in time so as to be non-aggregating. Such technologies, Zircon submits, must not be arbitrarily denied "access" to the restricted bands.

The main stumbling block, as Zircon sees it, lies in the current definitions in Part 15. The Rules currently differentiate between "intentional" and "unintentional" radiators in terms of restricted band access and, thus, arbitrarily penalize one type of potentially harmless emitter while ignoring the potentially harmful effects of the other. An example of this would be an office full of Pentium II-based PCs whose high clock frequencies (and harmonics) fall into certain restricted bands. Because the PCs are unintentional radiators, they are allowed to operate up to the Class A limits in these bands regardless of their aggregated emission levels. An office of PCs operating on the same clock frequencies, however, are far more likely to

[6] Obviously, this formula modification could be changed so as to allow more or less bandwidth at frequencies above 1 GHz.

interfere with a restricted band operation than would a building full of pulsed, randomly varied UWB devices operating below the Class B limits. Nonetheless, the office of Class A PCs is permitted to access the restricted bands whereas a single Class B UWB device is not.[7] Thus, whatever the historic reason for the regulatory distinctions between intentional and unintentional emitters in the context of restricted band emissions, the blanket application today makes no sense when applied to low power UWB technologies.

Zircon submits that Part 15 is the logical authorization program for low power UWB devices that operate below the Class B limits. For UWB emitters that operate above Class B but below Class A (e.g. fixed, commercial and industrial applications), a more rigorous authorization program may be necessary to protect restricted band licensees. For these, Zircon suggests that UWB deployment be coordinated via NTIA's Government Master File (GMF) which is routinely used to "register" non-government device emitters.[8] Use of GMF will allow for the tracking of higher power UWB devices, yet will avoid the licensing and administrative hassles that would attend common processing of possibly tens of thousands of

[7] For a very low power UWB device like Zircon's, signal aggregation is a non-issue as the device is intended only for low density applications (construction sites), requires manual operation, and involves itinerant usage at intermittent (random) intervals.

[8] In the case of a recent FCC waiver request for a microwave medical device, NTIA proposed using the Government Master File to keep track of all devices placed on the market. NTIA's proposal was for the FCC to forward all "requests for permission to operate" through the FCC liaison to the IRAC Frequency Assignment Subcommittee so that the "particulars" of such operations could be recorded in the GMF in accordance with "established procedures for receiving and recording frequency assignments for non-government entities." The GMF record would include the address and geographical coordinates of each facility where the device was to operate along with the name and phone number of the persons responsible for operation. See November 20, 1997 letter from Richard Parlow, NTIA, to Richard M. Smith, Chief, Office of Engineering & Technology.

UWB device applications. For higher power UWB devices that operate above the established Class A baseline, individual licensing by the Commission may be necessitated.[9]

Restricted Bands

As discussed above, the restricted band prohibitions arbitrarily disfavor one class of unlicensed devices over another by focusing on elusive terms like "spurious" and "fundamental" emissions. To a victim receiver, however, the type of emission is irrelevant; thus, the only plausible explanation for distinguishing among emission types lies in the age-old notion that fundamental emissions are more likely to "cluster" in a harmful manner than are spurious emissions. But, as the PC example above illustrates, such notions no longer hold true.

In the context of UWB technology the terms "spurious" and "fundamental" -- which are derived from narrow-band transmission technologies -- have no meaning. Indeed, prior to 1989 the restricted bands contained no prohibitions on emission types, although the emission levels were lower.[10] Thus, a low power UWB device, circa 1989, could have been routinely authorized by the Commission despite having emissions in one or more of these bands.

In the 1989 "Part 15 Rewrite", the number of restricted bands was increased, the emission levels were relaxed to the current limits and the "spurious-only" rule was introduced.

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[9] To minimize the FCC's licensing backlog (3 months or more for Part 90 licenses), Zircon suggests using a procedure currently in place for in-tank swept frequency radars operating in the 9-10 GHz band. These devices are "sold" pursuant to a waiver and conditional FCC license which permit immediate operations pending permanent Commission licensing.

[10] For emissions below 1000 MHz, the pre-1989 limit was 15 uV/m; for emissions above 1000 MHz it was 125 uV/m.

Devices then on the market that could not comply with the "spurious-only" rule were grandfathered by the Commission and include such products as swept frequency radars, transmitters used by telephone companies to detect buried markers, cable locating devices and various types of field disturbance sensors.[11]

Because "spurious" has no meaning for UWB emitters, the real question is what level of emissions to apply to the restricted bands. Evidence that the Commission's pre-1989 levels were, and still are, adequate to protect restricted band users comes from the Commission's own statements in Docket 86-422 (1988) that:

> "[T]he standard originally adopted for the restricted frequency bands ... was designed to provide for the operation of Part 15 devices in a manner which was undetectable by ... services authorized in these bands."

Accordingly, from a technical perspective there appears to be little, if any, tactical basis for the outright prohibition of low power UWB operations in the restricted bands.

Filtering

Signal filtering, or "notching", to avoid the restricted bands is not an option if it means the complete removal of all emissions as UWB device manufacturers would be forced to "prove the negative", a virtually impossibility. If, on the other hand, notching means the reduction in emissions to some sub-Class B levels in certain bands, the cost and complexity to achieve this would quickly overwhelm UWB technology and drive all but the most expensive

[11] See Section 15.205(d) and (e). The record in that docket proceeding indicates that virtually every company which requested relief was grandfathered under the "spurious-only" requirements in these bands.

devices off the market.[12] Even a few notched frequencies (e.g. FAA safety bands) represent difficult and costly tradeoffs. The practical result would be that the lowest notch will become the new Rule 15.205 baseline for all restricted band emissions, thereby severely limiting the usefulness of UWB technology.

Ultimately, all discussions on notching boil down to the question of what is the proper baseline for low power UWB emitters that will adequately protect restricted band users. Zircon submits that this question was addressed by the Commission in 1989 when it set the Class B limits and the absence of interference complaints by restricted band users over a decade of explosive growth in microprocessor technology confirms that the current fears of harmful interference from UWB technology is grossly overstated.

Measurement Issues

Zircon favors UWB device testing based on established industry practices for Part 15 emitters. The current field strength limits for Class A and B devices should be applied to UWB devices although Zircon would not object to the use of a spectral power density standard provided one can be correlated to these limits. By closely adhering to existing rules and measurement procedures the Commission will facilitate UWB device testing by the wide variety of laboratories and consultants already familiar with the Part 15 programs.

For peak readings (above 1 GHz) Zircon suggests that the sweep rate of the analyzer be reduced only until the observed levels are no longer increasing in order to identify the

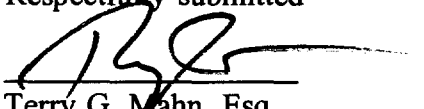
[12] Notching out restricted bands is not practical due to their number and close spacing. From 960 MHz to 5250 MHz there are 14 restricted bands occupying 2714 MHz out of the total of 4290 MHz. Thus, over 63% is restricted. Currently, there is no possible method of designing and building a filter that could notch these bands below some undefined level and still maintain the UWB characteristics.

maximum peak emissions but, in any event should be kept above some minimum sweep rate to ensure a sufficiently high pulse repetition rate so that wideband testing can be accomplished economically. Pulse desensitization correction factors should not be applied to UWB devices for reasons explained, at length, in the pending waiver petitions. As Zircon and others have shown, the application of pulse desensitization factors to very short, high repetition pulses grossly overstates the interference potential of a UWB device. Pulse desensitization factors were developed in the context of relatively narrowband emitters as a means of determining the interference potential (to victim receivers) that could not be predicted using conventional measurement techniques. Because UWB emissions will not be causing interference to "victim" receivers with UWB characteristics, the application of these factors to UWB emitters is inappropriate.

Conclusion

Based on the foregoing comments, Zircon respectfully requests that the Commission move expeditiously with this NOI and into a rulemaking proceeding to authorize the use of UWB technology under the Part 15 and other applicable rules.

Respectfully submitted



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December 7, 1998

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ATTACHMENT 1

Exhibit 1

Zircon Emissions
30 MHz - 3 GHz